https://doi.org/10.54890/1694-8882-2024-5-115
УДК 616.831-007.41:616.12-007.46]-053.2

КЛИНИЧЕСКОЙ СЛУЧАЙ СИНДРОМА АРНОЛЬДА-КИАРИ В СОЧЕТАНИИ С ДЕКСТРОКАРДИЕЙ У РЕБЕНКА

Н.А. Белых[1], А.М. Хрулёва[1], И.В. Пизнюр[1], Г.Ф.Раева[2]
[1]Рязанский государственный медицинский университет
[2]Городская детская поликлиника № 3
г. Рязань, Российская Федерация

Резюме. Синдром Арнольда-Киари - представляет собой редкое врожденное заболевание, характеризующееся снижением объема черепной коробке и изменением анатомии задней черепной ямки. Синдром Арнольда-Киари имеет несколько типов (от 1 до 4), каждый из которых характеризуется различной степенью сдавливания мозга и гидроцефалией, также недавно были добавлены его новые формы (0 и 1,5 тип). на качество жизни пациентов. Заболевание наиболее часто встречается у детей и молодых людей. По оценкам экспертов, его распространенность составляет от 3,2 до 8,4 случаев на 100 000 населения по всему миру. Встречаемость и тяжесть синдром Арнольда-Киари имеют статистически значимую тенденцию к увеличению у женского пола. Этиология синдрома Арнольда-Киари до сих пор не полностью изучена, но предполагается, что генетические факторы и воздействие на плод во время беременности могут играть главенствующую роль в его развитии. Клинически синдром проявляется головной болью, рвотой, нарушением глотания, различными двигательными нарушениями, нарушением координации и длительно сохраняющимся рефлексом Бабинского, слабостью и онемением в конечностях, проблемы со сном и другими симптомами. У пациентов также может развиться гидроцефалия, что увеличивает риск возникновения серьезных осложнений и требует оперативных вмешательств. В статье приведены данные в отношении распространенности, клинических проявлений и лечения синдром Арнольда-Киари, а также собственное клиническое наблюдение течения данного заболевания который сочетается с декстрокардией и гетеротаксией – зеркальным положением внутренних органов у пациента 10 лет. Синдром Арнольда-Киари на сегодняшний день относится к тяжелым врожденным заболеваниям нервной системы, трудно диагностируемом в раннем возрасте, поэтому педиатру важно понимать механизм возникновения данного заболевания, чтобы уметь не только устранить, но и предотвратить нежелательные последствия данного заболевания.

Ключевые слова: синдром Арнольда-Киари, декстрокардия, клинический случай, ребенок.

CLINICAL CASE OF ARNOLD-CHIARI SYNDROME IN COMBINATION WITH DEXTROCARDIA IN A CHILD

N.A. Belykh[1], A.M. Khrulyova[1], I.V. Piznyur[1], G.F. Raeva[2]
[1]Ryazan State Medical University
[2]City Children's Polyclinic No. 3
Ryazan, Russian Federation

Summary. Arnold-Chiari syndrome is a rare congenital disease characterized by a decrease in the volume of the cranial cavity and a change in the anatomy of the posterior cranial fossa. Arnold-Chiari syndrome has several types (from 1 to 4), each of which is characterized by a different degree of compression of the brain and hydrocephalus, and its new forms have recently been added (type 0 and 1.5). the quality of life of patients. The disease is most common in children and young people. According to experts, its prevalence ranges from 3.2 to 8.4 cases per 100,000 people worldwide. The

incidence and severity of Arnold-Chiari syndrome have a statistically significant tendency to increase in the female sex. The etiology of Arnold-Chiari syndrome has not yet been fully studied, but it is assumed that genetic factors and effects on the fetus during pregnancy may play a dominant role in its development. Clinically, the syndrome is manifested by headache, vomiting, swallowing disorders, various motor disorders, impaired coordination and long-lasting Babinsky reflex, weakness and numbness in the extremities, sleep problems and other symptoms. Patients may also develop hydrocephalus, which increases the risk of serious complications and requires surgical interventions. The article presents data on the prevalence, clinical manifestations and treatment of Arnold-Chiari syndrome, as well as our own clinical observation of the course of this disease, which is combined with dextrocardia and heterotaxia – the mirror position of internal organs in a 10-year-old patient. Arnold-Chiari syndrome today refers to severe congenital diseases of the nervous system that are difficult to diagnose at an early age, therefore it is important for a pediatrician to understand the mechanism of occurrence of this disease in order to be able not only to eliminate, but also to prevent the undesirable consequences of this disease.

Key words: Arnold-Chiari syndrome, dextrocardia, intrauterine development, children, clinical case, child.

Introduction. Arnold-Chiari syndrome (SAC) is a rare and serious neurosurgical disease characterized by displacement of the brainstem and cerebellum down through the opening of the occipital bone (occipital foramen). This leads to their compression and disruption of the normal circulation of cerebrospinal fluid and blood. As a result, there are a number of neurological symptoms that can strongly affect the quality of life of patients [1].

SAC is most common in children and young people, although cases of the disease also occur in middle age and the elderly. According to experts, its prevalence ranges from 3.2 to 8.4 cases per 100,000 people worldwide [2]. The occurrence and severity of SAC have a statistically significant tendency to increase in the female sex [3]. However, accurate incidence statistics are difficult, as many cases may remain undiagnosed or unconfirmed. SAC has various forms and degrees of severity, which makes it even more difficult to diagnose and treat.

Depending on the symptoms and displacement of the brainstem and cerebellum, the syndrome can be divided into several types: type 1 - omission of the tonsils of the cerebellum into the spinal canal below the level of the foramen magnum; type 2 - caudal displacement of the lower parts of the cerebellar worm, medulla oblongata, IV ventricle, combined with lumbosacral myelomeningocele and progressive hydrocephalus; type 3 - gross displacement of the posterior brain into the spinal canal, as well as high cervical or suboccipital encephalomeningocele (these changes are usually incompatible with life and are a truly congenital pathology); type 4 - cerebellar hypoplasia without its downward displacement; type 0 - currently, cases of a clinical picture characteristic of type 1 SAC, without omission of the tonsils of the cerebellum; 1.5 type - recently described as with omission of the tonsils of the cerebellum and lowering of the brainstem into the occipital foramen [4].

There are many theories explaining the development of SAC, some authors want to classify the Arnold-Chiari anomaly as a disease, because its formation is caused by the influence of mutagenic factors and chromosomal mutations that cause spontaneous changes in the structure of the PTPN gene, which is part of the RAS/MAPK signaling pathway, which is involved in the regulation of growth, differentiation, migration and repair of body cells [5].

The symptoms of SAC stem from three main pathophysiological consequences of the disordered anatomy of the posterior cranial fossa: 1) compression of the brainstem and upper spinal cord; 2) compression of the cerebellum; 3) disorders of cerebrospinal fluid flow at the level of the occipital foramen of the skull. The main clinical manifestations of SAC include headaches, tinnitus, dizziness, sleep problems, impaired coordination of movements, problems with reading, hearing or vision. In more severe cases, problems with breathing, chewing, swallowing and controlling urination may occur. These symptoms may manifest differently in each patient [1,4,6].

For the diagnosis of SAC, a comprehensive examination of the patient is usually required, including a clinical examination, anamnesis, as well as various instrumental studies. Computed tomography and magnetic resonance imaging of the brain and cervical spine can be used to confirm the diagnosis and determine the type and severity of the disease.

Treatment of SAC depends on the severity and type of the disease. In some cases, surgery may be required to create additional space in the occipital region to relieve compression of the brainstem and

cerebellum. This may include decompression of the posterior cranial fossa or more complex operations to restore normal circulation of cerebrospinal fluid. In patients with SAC, in whom surgery is impossible or not recommended, conservative treatment methods can be used, such as taking medications to relieve symptoms: dehydration drugs to reduce the amount of cerebrospinal fluid and reduce pain; nonsteroidal anti-inflammatory drugs to reduce pain and muscle relaxants in the presence of muscle tension in the cervical region as well as physiotherapy, massage and correction of posture and lifestyle. Treatment of SAC should be individual and appropriate for each patient, and requires a team approach, including neurosurgeons, neurologists, rehabilitologists and other specialists. A more thorough study of this rare disease and the development of new treatment methods are currently active areas of scientific research in medicine [6-9].

Dextrocardia is a rare congenital disease in which the heart is located to the right of the median line of the body, in the area of the right half of the chest. Dextrocardia is one of the rare variants of the abnormal location of the heart and can be accompanied by various structural defects that can disrupt the normal function of the heart. Dextrocardia can be caused by a variety of factors, including genetic mutations, environmental influences, and developmental disorders of the embryo. It is noted that dextrocardia is often combined with other congenital anomalies, such as transcoronal obstruction, improper placement of other organs and defects in the structure of the heart. This can complicate the diagnosis and treatment process. Children with dextrocardia may have developmental delays, breathing problems, circulatory disorders, and other serious medical problems [10-14].

The aim of the work was to describe our own clinical observation of the course of Arnold-Chiari syndrome in combination with dextrocardia in a 10-year-old child.

A clinical case. Patient A., born in 2014. It is known from the anamnesis of life that the boy was from 1 pregnancy, which occurred with toxicosis in the first trimester. At 11-12 weeks, there was a threat of interruption, acute respiratory viral infection at 22-23 weeks (outpatient treatment was received). On ultrasound examination (ultrasound) of the fetus at 12-13 weeks, no fetal abnormalities were detected. Ultrasound of the fetus at 24-25 weeks of pregnancy revealed: A right-sided, right-formed heart, a double-ventricle single ventricle with a graduate for the aorta, malposition of the main vessels, moderate pulmonary artery stenosis; meningomyelocystocele of the thoracic spine, Arnold-Chiari syndrome. The prognosis for fetal life is unfavorable. An abortion was proposed, which the woman refused. A consultation at the Bakulev National Medical Research Center for Cardiovascular Surgery and delivery at the regional clinical perinatal Center in Ryazan are recommended. The gestation period is 40-41 weeks.

The birth is the first, complicated by chronic intrauterine fetal hypoxia. Revealed fetal pathologies: dextrocardia, an echo sign of right-sided isomerism, a single ventricle of the heart, double exit of the main arteries from a single ventricle (presumably the right one) in combination with transposition of the main arteries; meningomyelocystocele of the thoracic spine, Arnold-Chiari syndrome; anemia of the first degree. The child was born with a body weight of 3660 g, a body length of 55 cm with an Apgar score of 5/7 points. The condition at birth is severe.

On the first day of his life, the boy was admitted to the intensive care unit of the state budgetary institution of the Ryazan region GBU RO "Regional Children's Clinical Hospital named after N.V. Dmitrieva" (Ryazan), where he was from 06/08/2014 to 07/22/2014. Upon admission, the condition is serious. The skin is pale pink, cyanosis of the nasolabial triangle at rest, with exertion – diffuse cyanosis. When humidified oxygen is supplied through the mask with a flow of 1-2 l /min – SpO2 – 87-89%. Shortness of breath involving the auxiliary muscles of the chest, respiratory rate – up to 58 per minute. Auscultation – hard breathing, wired wheezing. Heart tones are muted, soft systolic murmur at the top and on the left edge of the sternum, heart rate 148 per minute. The liver is + 1 cm, the spleen is not palpable. Motor activity is reduced. There is no swelling. The diuresis is adequate.

The following instrumental studies were performed:

– magnetic resonance imaging (MRI) of the thoracic spine from 06/9/2014: myelomeningocele in the thoracic region.

– MRI of the brain dated 07/18/2014: focal changes in the brain are not detected. The tonsils of the cerebellum are prolapsed in the large occipital opening by 18 mm. The lateral and III ventricles (up to 9 mm) of the ventricle are dilated, asymmetrically (D>S), a small perivetricular edema of the medulla is detected. The corpus callosum is traceable, flattened. The median structures of the brain are not displaced. The tip of the cerebellum is raised. The brain stem is not changed. The IV ventricle is slit-shaped, lowered. The subarachnodial convexital space has not been changed. The pituitary gland is not enlarged, the signal from it is not changed. MR is a picture of Arnold-Chiari syndrome type II.

– Ultrasound of the abdominal cavity from 06/08/2014: the structure of the liver is homogeneous. The vertical oblique size of the right

lobe is 57 mm. The gallbladder is contracted, the ducts are not dilated. The liver is localized on the left, the spleen on the right. Kidneys without features. The bladder is contracted.

– Ultrasound of the heart from 06/08/2014: a single ventricle of the heart, a double discharge of blood vessels from a single ventricle. Atrial septal defect. Dextrocardia.

– Chest X-ray from 06/23/14: focal and infiltrative changes in the lungs were not detected. Both lobes of the thymus gland are visible. The shadow of the heart in the right half of the chest.

– Computed tomography (CT) of the heart from 07/16/2014: a right-formed right-positioned heart, a single bicuspid and bicuspid ventricle anatomically left, hypoplasia of the right ventricle, functionally common ventricle left, ventricular septal defect, atrial septal defect, combined pulmonary artery stenosis, main vessel malposition, liver on the left, spleen on the right.

– Electrocardiogram (ECG) from 07/18/2014: sinus rhythm, normal position of the electrical axis of the heart. Overload of the single ventricle. Diffuse changes in the myocardium.

In a clinical blood test (07/16/2014), leukocytes – 9×109/l, erythrocytes – 4.2×1012/l, hemoglobin – 132 g/L, platelets – 308×109/L, lymphocytes – 53%, neutrophils – 29%, monocytes – 13%, erythrocyte sedimentation rate – 5 mm/hour.

In a biochemical blood test (07/16/2014), total bilirubin – 12.9 mmol/l, ALT – 30 units /l, AST – 36 units/L, creatinine – 54 mmol/L, urea – 4.4 mmol/L, C-reactive protein – 0 mg/l.

According to the results of laboratory and instrumental studies, the diagnosis was made: A right-sided right-formed heart, a double-stranded single ventricle with a graduate for the aorta, malposition of the main vessels, moderate pulmonary artery stenosis; congenital malformations of the brain and spinal cord: Arnold-Chiari syndrome, hypoplasia of the corpus callosum, internal biventricular hydrocephalus, radiculomeningocele in the thoracic spine.

Surgical treatment was performed at the GBU RO "Regional Children's Clinical Hospital named after N.V. Dmitrieva" (Ryazan) (11.06.2014) – herniotomy and plastic surgery of the radiculomeningocele of the thoracic spine. The patient was discharged home in a stable condition with the following recommendations: observation by a cardiologist at the place of residence, withdrawal from preventive vaccinations for 1 year, restriction of physical activity, taking levocarnitine 3 drops 2 times a day, then multivitamins courses 2 times a year, correction of therapy by a pediatrician at the place of residence.

In April 2015 (at the age of 11 months), he was undergoing routine treatment at the pediatric neurological department GBU RO "City Clinical Hospital No. 11 (Ryazan). According to the mother, the patient had a developmental delay – he did not sit down, did not sit, did not have support on his legs. When studying the objective status, it was revealed: a state of moderate severity, the child is conscious, emotional, plays with toys, shifts them, recognizes relatives. He can turn over on his stomach and back. The face is symmetrical. The toy is well watched. Muscle tone in the lower extremities is reduced, there is a crunch in large joints. Tendon reflexes are alive, Babinsky's reflex is positive on both sides; holds his head, groups well, holds support on his forearms.

MRI of the brain (01/20/2015): type II SAC, corpus callosum hypoplasia, triventricular hydrocephalus.

Neurosonography (01/21/2015): expansion of the ventricular system, anterior horns of the lateral ventricles - D20 mm, S18 mm hemispheric fissure - 4 mm, third ventricle - 10 mm, bone diastasis - 3 mm.

Consulted by a cardiologist - recommendations are given, treatment is agreed. A consultation with a neurosurgeon was received, at the time of examination, surgical treatment was not indicated. The following treatment is prescribed: intramuscular injections of cortexin and vitamin B12, physical therapy. He was discharged with improvement under the supervision of a neurologist at his place of residence.

At the age of 11 months, repeated MRI of the brain was performed (30.04.2015): negative dynamics in the form of an increase in dilation of the ventricular system, without the phenomenon of periventricular edema, was revealed on the obtained MR scans, in comparison with the study with the latest study. A planned surgical intervention was performed - ventriculoperitoneal bypass surgery. The postoperative period was smooth. He was discharged with positive dynamics under the supervision of a neurologist at his place of residence.

In June 2016, at the age of 2, the child was urgently admitted to the Federal State Budgetary Institution "National Medical Research Center for Cardiovascular Surgery named after A. N. Bakulev" of the Ministry of Health of the Russian Federation (Moscow) with complaints of shortness of breath, cyanosis, fatigue, decreased appetite. Upon admission: the general condition is serious. Height – 80 cm, weight – 10.5 kg. Skin color cyanosis, saturation – 78%. The skin and mucous membranes are cyanotic. Noises: systolic, to the right of the sternum, epicenter along the right edge of the sternum. The chest is of the correct shape. Syndrome of motor disorders. Mental development: a delay in the pace of psychomotor development.

The following instrumental studies were performed: ECG (06/9/2016): sinus rhythm, heart rate – 125 beats/min, signs of hypertrophy of the left ventricle and atrium, blockade of the left leg of the Hiss bundle.

ECHO-KG (06/9/2016): a right-formed right-placed heart. The only bicuspid and bicuspid ventricle are anatomically left. The final diastolic size of the left ventricle is 3.4 cm. The ejection fraction of a single ventricle is 65%. Left atrioventricular valve: tricuspid, flaps thin, moderately prolapsed, insufficiency +1.5 FC TC 20 mm. Right atrioventricular: mitral FC 15 mm. Insufficiency +1.5. Combined pulmonary artery stenosis (PA) with a gradient of 80 mmHg The branches of the PA are 9 mm. NLA + 1. The defect of the atrial septum is a central 10 mm.

Chest X-ray (06/9/2016): there are no infiltrative and focal changes in the lungs. The roots are structural. The pulmonary pattern is depleted along the periphery. The cardiothoracic index is 57% (normally up to 50%). The shadow of the heart in the right half of the chest.

Apexcardiography (06/10/2016): a right-formed right-placed heart. The only anatomical left ventricle of the heart. The transpositional arrangement of the main arteries. Valvular and supravalvular pulmonary artery stenosis. Aortopulmonary collateral arteries from the descending aorta to the right lung.

Surgical treatment was prescribed (06/15/2016): the imposition of a bidirectional cavopulmonary anastomosis with ligation of the trunk of the pulmonary artery in conditions of artificial circulation and hypothermia.

In clinical blood analysis: leukocytes (06/10/2016) – 7.3×109/l, erythrocytes – 4.56×1012/L, hemoglobin – 131 g/L, platelets – 405×109/L, lymphocytes – 18%, neutrophils – 70%, monocytes – 9%, erythrocyte sedimentation rate – 5 mm/an hour. In the biochemical analysis of blood (06/10/2016): total bilirubin – 4.1 mmol/l, total protein - 69 g/l, creatinine – 18 mmol/L, potassium – 4.4 mmol/L, sodium - 132 mmol/L, glucose - 3.92 mmol/L. Surgical treatment was prescribed (06/15/2016): the imposition of a bidirectional cavopulmonary anastomosis with ligation of the trunk of the pulmonary artery in conditions of artificial circulation and hypothermia. The postoperative period is without complications. He was discharged with improved condition under the supervision of a cardiologist at his place of residence.

At the age of 5, he was admitted to the pediatric neurological department of the GBU RO "City Clinical Hospital No. 11" in Ryazan with complaints from his mother of an awkward gait, weakness in his right leg, restlessness and frequent distractions. Upon examination, it was revealed: the face is symmetrical, the cranial nerves are intact. Cranial nerves: movement of the eyeballs in full, installation nystagmus, tongue along the midline. Speech is phased, neatness skills are formed. Muscle tone is reduced in both legs. Tendon reflexes are alive. Babinsky's positive reflex on both sides.

MRI of the brain (05/14/2019) – the condition after ventriculoperitoneal bypass surgery, a decrease in prolapse of the tonsils of the cerebellum.

MRI of the spinal cord (05/15/2019) – concluded myelomeningocele in size 4.6*1.6*1.7, in dynamics – reducing the size to 1.9*0.3*0.6

Electroencephalography (05/14/2019): in areas free of artifacts, a variant of the norm.

ECG (05/14/2019): dextrocardia, sinus arrhythmia, tachycardia, hypertrophy of the left ventricle, violation of the repolarization process.

Chest X-ray (01/23/2020): focal and infiltrative changes in the lungs were not detected. Both lobes of the thymus gland are visible. The shadow of the heart in the right half of the chest. General blood test, biochemical blood test and general urine test (01/24/2020): no deviations. Treatment was prescribed: intramuscular injections of cortexin and vitamin B12, physical therapy, massage, sinusoidal modulated currents to the lower extremities. Condition at discharge: he underwent treatment well, got stronger physically, walks more confidently over long distances, the neurological status is the same. He was discharged at the end of the course of treatment. Recommendations: follow-up by a neurologist, cardiologist at the place of residence. Exercise therapy should be continued at home or in a polyclinic at the place of residence. Gliatilin solution of 2 ml 2 times a day for 1 month, then supradine kids with choline 1 tablet 2 times a day for 1 month. A repeat course of treatment in the pediatric neurological department after 6 months. Currently, the child's condition is stable, dynamic monitoring is being carried out.

Conclusions. Thus, early detection and correct diagnosis of Arnold-Chiari syndrome plays an important role. This will allow you to prescribe the optimal treatment strategy and prevent the progression of neurological symptoms. To achieve this goal, a wider availability of specialized diagnostic methods, such as MRI and computed tomography of the posterior cranial fossa, is necessary. Further research in the field of SAC will allow for a deeper investigation of the mechanisms of pathology development and the development of more effective treatment methods. This will improve the prognosis of patients and ensure more successful management of this rare disease, as well as the quality of life of children with congenital anomalies.

References

1. *Nishikawa M, Bolognese PA, Yamagata T, Naito K, Sakamoto H, Hara M, et al. Surgical Management of Chiari Malformation Type I and Instability of the Craniocervical Junction Based on Its Pathogenesis and Classification. Neurol Med Chir (Tokyo). 2022;62(9):400-415. https://doi.org/10.2176/jns-nmc.2022-0078*
2. *Захарова Е.С., Воробьева А.В. Синдром (аномалия) Арнольда – Киари как проявление врожденного заболевания в практике врача-педиатра (клинический случай). Вестник новых медицинских технологий. 2019;3:34-39. [Zaxarova E.S., Vorob`eva A.V. Sindrom (anomaliya) Arnol`da – Kiari kak proyavlenie vrozhdennogo zabolevaniya v praktike vracha-pediatra (klinicheskij sluchaj). Vestnik novy`x medicinskix texnologij. 2019;3:34-39(In Russ.)] https://doi.org/10.24411/2075-4094-2019-16387*
3. *Кантимирова Е.А., Шнайдер Н.А., Петрова М.М., Строцкая И.Г., Дутова Н.Е., Алексеева О.В. и др. Встречаемость аномалии Арнольда–Киари в практике невролога. Неврология, нейропсихиатрия, психосоматика. 2015;7(4):18–22. [Kantimirova EA, Shnaider NA, Petrova MM, Strotskaya IG, Dutova NE, Alekseeva OV, Shapovalova EA. The incidence of Arnold–Chiari malformation in neurological practice. Nevrologiya, neiropsikhiatriya, psikhosomatika = Neurology, Neuropsychiatry, Psychosomatics. 2015;7(4):18-22. (In Russ.)]. https://doi.org/10.14412/2074-2711-2015-4-18-22*
4. *Sari SA, Ozum U. The executive functions, intellectual capacity, and psychiatric disorders in adolescents with Chiari malformation type 1. Childs Nerv Syst. 2021;37(7):2269-2277. https://doi.org/10.1007/s00381-021-05085-z*
5. *Han Y, Chen M, Wang H. Chiari I malformation in patients with RASopathies. Childs Nerv Syst. 2021;37(6):1831-1836. https://doi.org/10.1007/s00381-020-05034-2*
6. *Thompson DNP. Chiari I-a 'not so' congenital malformation? Childs Nerv Syst. 2019;35(10):1653-1664. https://doi.org/10.1007/s00381-019-04296-9*
7. *Klekamp J. Chiari I malformation and syringomyelia. Neurosurg Focus. 2015;38(4):E12. https://doi.org/10.3171/2015.1.FOCUS14783*
8. *Мозаев С.В. Особенности патогенеза, клиники и диагностики аномалии Киари 1-го типа. Нейрохирургия. 2012;3:1 3-9. [Mozaev S.V. Features of pathogenesis, clinic and diagnostics of Chiari type 1 anomaly. Nejrohirurgija. 2012;3:1 3-9. (In Russ.)].*
9. *Najm HK, Karamlou T, Ahmad M, Hassan S, Yaman M, Stewart R, et al. Biventricular Conversion in Unseptatable Hearts: "Ventricular Switch". Semin Thorac Cardiovasc Surg. 2021;33(1):172-180. https://doi.org/10.1053/j.semtcvs.2020.08.010*
10. *Leonardi B, Perrone M, Calcaterra G, Sabatino J, Leo I, Aversani M, et al. Repaired Tetralogy of Fallot: Have We Understood the Right Timing of PVR? J Clin Med. 2024;13(9):2682. https://doi.org/10.3390/jcm13092682*
11. *Stout KK, Daniels CJ, Aboulhosn JA, Bozkurt B, Broberg CS, Colman JM, et al. 2018 AHA/ACC guideline for the management of adults with congenital heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2019;139(14):e698-e800. https://doi.org/10.1161/CIR.0000000000000603*

For citation

Belykh N.A., Khrulyova A.M., Piznyur I.V., Raeva G.F. Clinical case of Arnold-Chiari syndrome in combination with dextrocardia in a child. Euroasian Health Journal. 2024;5:115-121. https://doi.org/10.54890/1694-8882-2024-5-115

Authors information

Belykh Natalia Anatolyevna – MD, Professor, Head of the Department of Faculty and Polyclinic Pediatrics with the Course of Pediatrics of Ryazan State Medical University, Ryazan, Russia. ORCID ID: 0000-0002-5533-0205, e-mail: nbelyh68@mail.ru.

Khruleva Anastasiia Maksimovna - student, Ryazan State Medical University named after Academician I.P. Pavlov, Ministry of Health of the Russian Federation, Ryazan, Russian Federation. ORCID ID: 0009-0000-1164-7270, e-mail: n.khruleva2017@yandex.ru.

Pisnyur Inna Vladimirovna– Assistant of the Department of Faculty and Polyclinic Pediatrics with the Course of Pediatrics of Ryazan State Medical University, Ryazan, Russia. ORCID ID: 0000-0002-9267-439X, e-mail: innaabramova@yandex.ru

Raeva Galina Fedorovna - is a pediatrician, GBU RO "City Children's Polyclinic No. 3", Ryazan, Russia. ORCID ID: 0009-0006-5627-8732, e-mail: Raeva1967@yandex.ru